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MEMO

MEMO CONCERNS

SIMO-3.6.16 RELEASE NOTES

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DISTRIBUTION

SIMO users

PROJECT NO.	DATE	PERSON RESPONSIBLE / AUTHOR	NUMBER OF PAGES
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APPENDIX A: Modifications of SIMO "sys-files" SIMO version 3.4 to 3.6

1 SIMO-3.6 RELEASES

1.1 SIMO 3.6.0
Released 07-12-10. Initial release of SIMO 3.6

1.2 SIMO 3.6.1
Released 07-12-20. Error correction

1.3 SIMO 3.6.2
Released 08-05-22. Error corrections

1.4 SIMO 3.6.3
Released 08-08-28. Error corrections

1.5 SIMO 3.6.4
Released 08-11-03. Error corrections

1.6 SIMO 3.6.5
Released 09-03-03. Error corrections

1.7 SIMO 3.6.6
Released 09-08-20. Error corrections

1.8 SIMO 3.6.7
Released 10-01-01. Error corrections

1.9 SIMO 3.6.8
Released 10-06-01. Error corrections

SIMO 3.6.9 – 3.6.11 omitted

1.10 SIMO 3.6.12
Released 10-10-18. Error corrections

1.11 SIMO 3.6.13
Released 11-01-15. Error corrections

1.12 SIMO 3.6.14
Released 11-04-15. Error corrections

1.13 SIMO 3.6.15
Released 11-10-21. Error corrections

2 SIMO version number

SIMO 3.6 is the new official version of SIMO replacing SIMO 3.4 that was initially released in June 2004. The sub-version number is added to track corrections made to the version. Subsequent (bug fix) releases will be labelled 3.6.1, 3.6.2, etc.

The odd numbered versions, e.g. 3.3, 3.5, are reserved for internal development versions. The next official release will therefore be SIMO 3.8.

3 SIMO-3.6 license management system

SIMO v3.6 is license-managed using the FLEXlm software license management system. SIMO 3.4.0 and higher use FLEXlm version 9.2. If you want SIMO to be usable from any networked computer on your site you must run a license manager on a server in your network.

In order to issue license keys for this license manager, MARINTEK needs the following info on your server:

- **Hostname and IP address**
- **Operating system and version (Win2k/WinXP, HP-UX, Linux and SGI supported)**
- **FLEXlm hostID**

Utilities to generate the FLEXlm hostID and FLEXlm End Users Guide can be downloaded from:

http://www.macrovision.com/

Utilities and manual are also included on your distribution media.

Your IT-staff is probably already familiar with this procedure as FLEXlm is used by a large number of other applications (e.g. Matlab).

If you have any questions, please contact SIMO support (SIMO@marintek.sintef.no).

4 Run-time DLL

You might have to upgrade the FORTRAN dlls on your computer. If you get a system error message mentioning the file “DFORMD.DLL” run the dll install program “VFRUN66AI.exe” found on your distribution medium.

5 Work array size in DYNMOD and OUTMOD

The size of the DYNMOD and OUTMOD work arrays may be specified using the environment variable SIMO_MEM. The variables give the size in MB, i.e. 4 times the number of million words. The minimum size is 4 MB and the maximum size is 800 MB.

The default size of the DYNMOD and OUTMOD work arrays is 4 million words. This corresponds to specifying16MB

6 Error corrections

6.1 Corrections included in SIMO 3.6.16

- **INPMOD. Calculation of retardation functions.**

If frequency dependent damping is given at a SIF-file, some retardation functions have to be calculated (even if the variation damping is small). Corrected

- **Print of static forces in STAMOD.**

The thrust forces are now printed separately and not included in positioning forces.

6.2 Corrections included in SIMO 3.6.15

- **Diffracted wave transfer functions.**

The diffracted wave transfer functions have to be given for wave elevation and particle velocity in X, Y and Z direction. A check that all 4 trf's are given is included.

- **Dynamic positioning. Thrust forces.**

STAMOD option "Active DP in static calc. (Y/N)" did not work.
If thrusters were specified and no DP system, the thrust forces became zero in DYNMOD. Corrected.

6.3 Corrections included in SIMO 3.6.14

- **Directions for which responses should be pregenerated.**

The directions were not always calculated correctly. Improving error message.

6.4 Corrections included in SIMO 3.6.13

- **Directions for which responses should be pregenerated.**

The directions were not always calculated correctly. Corrected.

- **Fixed force elongation.**

When the distance between the coupling points becomes zero, the coupling force direction will be undefined. Corrected.

- **Read force time series from file**

If a force time series are read from file, an error may occur in DYNMOD. The time series written to file are blocked according to available space (Set with the environment variable SIMO_MEM). When more than one block is used, an error may occur when force time series are read from file. Corrected.

- **FLEXlm license wait**

Windows versions may now wait for a FLEXlm license to become available. Waiting is enabled by setting the environmental variable MARINTEK_LICENSE_WAIT to any non-null string. Windows versions only.

6.5 Corrections included in SIMO 3.6.12

user manual section ref.

- **Depth dependent hydrodynamic coefficients for 3-DOF body**

If the parameter IREF is set to 2 (depth referred to still water level), slamming forces were not included in the calculated force. The stored force time series did not include the force due to contact with bottom. Corrected

- **Body component**

If a FIXED POINT (Data group BODY COMPONENT) is defined without a COUPLING WINCH, the coupling lines attached to this coupling point will get a wrong line tension. Corrected

- **Distributed element force.**

Depth-dependent coefficients may be specified under Distributed Element Force (DEF) data. If the parameter ZREF is different from zero, the calculated DEF-force will be wrong. Corrected

- **Scaling of dynamic positioning estimator time series.**

Some of the time series of response type 23 were not scaled correctly. The series were not scaled from (radians) to (degrees). For Kalman filter series, the surge, sway and yaw frequency series were not converted from (rad/s) to (Hz). Corrected.

- **Slamming forces.**

Slamming forces for data group "Distributed element forces" are calculated if depth-dependent coefficients are given. The calculated slamming forces were too small.

- **Pre-computation of responses**

If the transfer functions were given for directions -180, -150, ... +180 degrees, the pregenerated responses were not always generated for all necessary directions. This has been corrected.

- **Reading body motions from file.**

For body type 4, the body motions may be read from file. If this is used for a body and the next body is not of type 4, one had to set the parameter IMPTYP to zero. Corrected.

6.6 Corrections included in SIMO 3.6.8

- **Presentation of restoring force (STAMOD).**

Forces from coupling elements not included in restoring force curve. The error has been present since SIMO release version 3.6.0. Corrected.

- **Calculation of coordinates of contact points when guide points are used**

In some cases the coordinates of the contact points were not calculated correctly. This caused spikes in the generated force time series. Corrected.

- **Reading wave drift force coefficients from MOSES file**

If data for more than 5 directions were given, the drift force coefficients were not read correctly from MOSES data file. Corrected

- **Time dependent mass; tank with geometry**

Sometime DYNMOD simulation could terminate uncontrollerd and result in "core dump". Corrected

- **Time dependent mass; tank with geometry**

If a "sys-file" containing "tank with geonetry" was read twice, an error occurred.

Corrected

- **Body motions are read from file (body type 4),**

The body velocity at the last time step was calculated incorrectly. Corrected. No effect at results. Errouneous velocity at the last step in a simulation will normally not cause any error. However, if a coupling element with large damping is connected to the body, then the DYNMOD simulation may end with an error.

- **Guide point**

Guide point could not "leave" guide wire when number of guide points was specified to one. Corrected

6.7 Corrections included in SIMO 3.6.7

- **WAMIT "out" file containing RADII of gyration and not mass matrix**

In this case, INPMOD generated an erroneous mass matrix. Corrected.

- **NUMBER OF SUBDIVISIONS IN SIMULATION**

Maximum "Number of subdivisions" in DYNMOD has been increased from 100 to 10 000. No effect on results.

- **FENDER AND BUMPER; POSITIONING AND COUPLING.**

It was not possible to specify parabolic interpolation on both FORCE and DAMPING characteristics (INTPOM=4). Corrected

6.8 Corrections included in SIMO 3.6.6

- **WAVES IN TIME DOMAIN;**

Incorrect realization of waves in time domain when using FFT and cosine-series in combination or cosine-series alone – The frequencies and frequency components were not treated consistent. The option FFT and cosine-series with different realization has been removed.

- **VISUALIZATION OF REGULAR WAVE SIMULATED WITH "COSINE SERIES"**

A regular wave will be visualized if not more than one wave component is given. If swell is given, waves will not be visualized.

- **FORCE TIME SERIES READ FROM FILE**

When force time series are read from file and the force is specified to be given in local coordinate system, the moment will only be correct if Euler simulation method is used.

- **GENERAL LINE DATA**

If a system contained "general line data", STAMOD terminated if static forces were printed.

- **MOMENTS FROM FENDERS**

The calculated moment at a fender point was slightly wrong.

- **MULTIPLE WIRE COUPLING**

The calculation of the branch point position is improved.

6.9 Corrections included in SIMO 3.6.5

- **READING TIME SERIES FROM FILE**

If time series were read from more than one ASCII file, the reading might fail and lead to program termination. *6.3.1* *6.3.2*

Sporadic program termination

- **1st ORDER WAVE EXCITATION FORCES FROM MOSES FILE**

The force transfer functions were not read correctly. The error has been corrected *4.1.2*

Erroneous results

- **WAVE EXCITATION FORCE BASED ON COSINE-SERIES**

Error in wave excitation forces when the calculations were based on cosine-series. The error has been corrected. (No error in application of visualization waves) *6.2.1*

Erroneous results

- **DISTRIBUTED ELEMENT FORCE**

If no wave kinematics was specified for the last slender element or fixed body element attached to a body (IWDHF=0), wave kinematics were not calculated for any of the slender or the fixed body elements attached to that body. The error has been corrected. *A 3.18*

Erroneous results

- **WINCH RUN**

1) The formulation for winch run was not consistent with the time integration method. This concerns Runge-Kutta and Newmark-β integration schemes. This resulted in incorrect tension in the winch wire during winching. Work around: Use Euler integration scheme with short time steps. The error has been corrected. *A 3.22* *A 3.23*
2) The maximum acceleration specified for the winch run was not used correctly. This caused too high peak loads (transient loads) at the start and at the end of the winch run interval. The error has been corrected.

Erroneous results

- **Improvement to Wave drift forces**

Keep value constant and equal to value for largest given frequency instead of use linear extrapolation on force transfer function above highest given frequency.

Insignificant changes to results. However, input dependent.

- **MARINTEK SIMULATOR ENVIRONMENT – Real time communication package**

Program termination running RIFLEX "coupled analysis". The error has been present since SIMO 3.6.3. The error has been corrected.

6.10 Corrections included in SIMO 3.6.4

- **DISTRIBUTED ELEMENT FORCE – SLENDER ELEMENT**

Error in all wave loads based on added mass or drag coefficients except when depth dependent coefficients are specified. The error concerns any strip located between mean water level and the instantaneous wave elevation. The error has been present since SIMO 3.6.3 *A 3.18*

Erroneous results

- **MASS MATRIX (INPMOD)**

Wrong sign in coupling terms IYX, IZX and IZY when importing data from WADAM (SIF-file), MOSES-file or SWIM-file

Normally of small significance, however, system dependent

- **NUMBER OF SAMPLES IN COMPUTED RETARDATION FUNCTION (INPMOD)**

The requirement to maximum number of samples (500) in the retardation function has been relaxed.

May give insignificant changes to results.

- **PRESENTATION OF BUMPER FORCE CHARACTERISTCS**

The presented BUMPER force characteristics were incorrect.

No consequence to results

6.11 Corrections included in SIMO 3.6.3

- **DISTRIBUDED ELEMENT FORCE: SLENDER ELEMENT and FIXED BODY ELEMENT**

In the case IVOL = 1 (include gravity force and hydro-static buoyancy force), but no wave particle acceleration was specified, parts of the Froude Krylov were erroneously taken into account. *A3.18.2* *A3.18.3*

Erroneous results.

- **BERTHING FENDER DATA and FENDER COUPLING**

The combination of "spherical fender point" and "fender roller" was intended to be an illegal specification. Check on input has been included. *A3.22.4* *A6.6*

Erroneous results.

- **FIXED BODY ELEMENT**

The wave force at a FIXED BODY ELEMENT was computed at wrong position of the element. *A3.18.3*

Erroneous results.

- **Zero thruster force in case of no DP-system**

The thrust forces were erroneously set to zero in stead of using the specified thruster force.

6.12 Corrections included in SIMO 3.6.2

- **MULTIPLE WIRE COUPLING in connection with BODY COMPONENTS**

The error occurs when attachment points of multiple wire coupling are specified by use of BODY COMPONENTS. *A6.2*

Erroneous results.

- **Too small internal work array (STAMOD)**

In case of irregular waves and no wave drift coefficients given for any body results from STAMOD are erroneous.

Erroneous results (STAMOD).

- **Export responses for visualization (STAMOD)**

Correction to avoid access violation when export of forces from force models is enabled.

No consequence to results

- **Swell specrum (DYNMOD)**

Number of frequency components used in swell spectrum was determined from frequency increment used for wind waves.

Normally of no consequence to results.

- **Import of data from MOSES type file (INPMOD)**

Reading force transfer functions from MOSES file has been corrected

6.13 Corrections included in SIMO 3.6.1

- **Pre-generation of time series**

Error in computation of wave response time series based on transfer functions. The error was introduced in SIMO 3.6.0

Erroneous results (DYNMOD).

6.14 Corrections included in SIMO 3.6.0

This section describes known errors contained in SIMO-3.4.12 and earlier versions, that have been corrected in SIMO-3.6

- **Restoring forces computed by STAMOD**

For bodies with "body number" > 1, the applied and presented restoring forces during static analysis are incorrect. The only reliable results for restoring force in STAMOD are for body number 1, (the first body at the "sys"-file).

Erroneous results (STAMOD).

- **Moments from "docking cone coupling" elements were wrong**

For bodies with "docking cone coupling" the moments were not calculated correctly. This will normally have small influence on the calculated motions, but if the "docking pin" at a small body is located at some distance from the origin, the incorrect moments may be of significance. *A6.5*

Erroneous results.

- **Hydrodynamic coupling**

The coupling forces due to hydrodynamic coupling were not calculated correctly unless the "hydrodynamic coupling retardation functions" were given only at the diagonal, the results will be correct, otherwise they will be wrong. *A4*

Erroneous results.

- **DP system with reference point located at another body**

Error in low-pass filtering causes erroneous results

Erroneous results.

A3.22.7

- **Application of diffracted wave transfer function.**

Local diffracted wave particle velocity- and acceleration components were applied as if they referred to global system.

Erroneous results.

A3.18.4
A3.19.1

- **Storage of fender coupling forces**

For body numbers 2, …,NBDY the normal and tangential components of the fender force may not have been stored even if specified.

Affects presented coupling forces only.

7 New / improved modelling functionality SIMO-3.6

user manual section ref.

7.1 SIMO basics

- **Import data generated by the computer program MOSES**

  The possibility to import data generated by MOSES (*.hyd-file) has been implemented. Frequency added mass and damping, First order wave force transfer functions, Second order wave drift coefficients may be imported. It not possible to read first order motion transfer functions (RAOs).

- **Ballast tanks** *A3.4.3*

  The effect of filling ballast tanks with specified dimensions is facilitated by use of the option: Time Dependent Mass. Quasi-static forces due to free-surface effects are included.

- **Finite fender plane** *A3.22.4*

  It is possible to specified fender planes with specified dimension. In previous versions a fender plane was assumed to be infinite *A6.6*

- **Lift line coupling** *A6.3*

  The lift line model gives fast and quite accurate model for prediction of the total static and dynamic line end forces and load offset. The simplified lift line is modelled by nominal E-module, diameter, transverse and longitudinal drag coefficient and the mass per meter length. The model gives zero compressive forces. The basic model is a straight line. A modification to the straight-line assumption is made to take into account the transition of horizontal motion and forces from the crane to the lifted body due to WF motion, LF motion and transient motions (moving vessel).

  Current forces and the damping forces of the line acting on the body and the load are calculated along a straight line. The line weight and buoyancy and the inertia forces are also calculated along this line.

- **Docking cone** *A3.22.3*

  The load formulation is extended to include radial damping forces and friction forces parallel to the cone surface. *A6.5*

- **Frequency dependent wave drift damping** *A3.16.2*

  Newman's method. The implementation has been completed. It also includes importing frequency dependent wave drift damping coefficients from SIF files.

- **DP system** *A3.22.7*

  The time step dependence of the Kalman filter gains has been removed.

  The mass decoupling term is improved in the PID-controller.

- **Body component specification** *A3.23*

  This modelling option defines two types of connection points for coupling elements:
  - Fixed points at a defined location on the body
  - Guide point at a defined location on the body, but sliding along a coupling element,

  In case of fixed point it is possible to specify types of equipment that may be located at the point:
  - Winch
  - Motion compensator (DLL only)

  A guide point facilitates the possibility to model **guide wires** and **sheaves**.

  A coupling element may be connectable/disconnectable at a fixed connection point based on HLA communications.

  The location of a fixed connection point may be controllable based on HLA communication simulating crane operations

- **Body type 4** *A3.1*

  Body type 4 is assumed earth fixed or given prescribed motions read from file. The input specification is similar to body type 1. The use of body type 4 facilitates coupling element functionality where one end is earth fixed.

- **Torsethaugen wave spectrum** *A7.3*

  The formulation has been modified according to Torsethaugen ISOPE paper 2004-JSC-193

- **Wind velocity in time domain**

  This is an option that avoids pre-generation of wind velocity, and the length of the wind time series will not limit the simulation duration. In the future it will be possible to change the wind specification by HLA communication.

7.2 SIMO visualisation (SIMVIS) and HLA communication

Results from SIMO (and RIFLEX) static and dynamic analyses can be visualised by use of the 3D visualisation tool SimVis. SimVis is licensed directly from MARINTEK.

SIMO can also exchange selected parameters with other programs in a simulator setup. The communication is handled by a Run Time Infrastructure (RTI) bus, which uses a standard TCP/IP network protocol, administered by High Level Architecture (HLA) software. HLA communication is not available as standard SIMO licence contract conditions. HLA communication was introduced in SIMO-v3.4

- **Wave visualisation** *Visualisation / HLA*

  Long-crested waves (by FFT or cosine series) and short-crested visualisation waves including diffracted waves may be visualised by SIMVIS both subsequent to analysis and for HLA communication

- **Visualisation of line profiles** *Visualisation/HLA*

- **Crane operation** *HLA*

  The location of a body component fixed connection point may be controllable by HLA communication.

- **Connect / disconnect lines at coupling points** *HLA*

  The functionality is implemented for coupling specification of type simple wire coupling and lift wire coupling

- **Import of seafloor depth for soil penetration** *HLA*

  The reference depth for start of penetration may be updated from seafloor topology data, for the actual (x,y) position of the body.

8 System description file modifications

This section gives a brief overview of modifications to the system description file for version 3.6 as compared to version 3.4. Description of new functionality is not described. A detailed description of modifications both with regard to old and new functionality together with examples, is given in Appendix A.

DOCKING CONE POSITIONING
Version 3.4: Specified as: FIXED FORCE ELONGATION with IMETH =4
Version 3.6: Specified as: DOCKING CONE POSITIONING

DOCKING CONE COUPLING
Version 3.4: Specified as: FIXED ELONGATION COUPLING with IMETH = 4
Version 3.6: Specified as: DOCKING CONE COUPLING

SIMPLE WIRE COUPLING
Data regarding winching have been removed. That is:
The parameter NRUN and lines with data TSTART TSTOP RUNVEL are removed. Data regarding winch run are moved to data group BODY COMPONENTS

MULTIPLE WIRE COUPLING
Similar modifications as for SIMPLE WIRE COUPLING

DYNAMIC POSITIONING DATA
Extra input line

9 Menu modifications

Note that the menus applied during run of all modules have been modified. However, all previous options for analysis provided by previous versions have been maintained. This means that macro files have to be rewritten.

10 Useful tools

10.1 SIMO modelling tutorial

Simo modelling tutorial is a new tool. The intention of the tutorial is to give some advice on how SIMO can be used to model the marine units and the various mechanical systems often encountered in different marine operations. Thus the focus has been, based on experience, to comment on how the numerous models available in SIMO can be used alone or in combination, to represent practical cases as well as possible. Also comments are given on where special attention should be paid to avoid numerical problems. It has not been the intention to write a general textbook on marine hydrodynamics. Neither has it been an intention to replace the Theory Manual or the Users Manual, where a more complete description of the theory and input data is found. It is our hope that the tutorial can give some additional advice to the user regarding practical use of SIMO.

The zip-file "SIMO_Tutorial.zip" contains the necessary files. The file may be downloaded from the SIMO web pages. Extract the files and double click on the file "SIMO_modellingTutorial.html " to run the tutorial.

10.2 System Description File generator – SysGen

Together with the release of SIMO 3.4.0, a new utility SysGen is made available. The purpose of SysGen is to read hydrodynamic coefficients from WAMIT result files (wamit.out, wamit.1, wamit.4 etc.), calculate retardation functions and write all relevant data to a SIMO system description file.

The following data groups are written (if present on the Wamit result files):

- Mass data including added mass matrix (infinite/zero)
- Hydrostatic stiffness
- First order wave force transfer functions
- First order motion transfer functions
- Retardation functions
- Second order wave drift coefficients
- Hydrodynamic interaction between bodies
    - Coupled added mass data
    - Coupled retardation functions

Note that the present version of SysGen does not write QTF data.

SysGen is run from a console window:

```
java -jar path\to\SysGen.jar wamit.out
```

Options:

```
-time_delay <dt> 'retardation function time delay' (Default 0.5)
-pressure        'drift force by pressure'
-info            'info messages'
```

SysGen requires a java virtual machine to be installed on your system. Virtual machines can be downloaded from http://www.java.com/. Please note that SysGen is beta software. The sys-file produced by this utility should be thoroughly checked. SIMO-INPMOD is the recommended tool for sys-file generation for cases where hydrodynamic interaction between vessels is not present.

SysGen does not read sif-files from WADAM directly. As a work around for WADAM users that want to use SysGen, one may specify WADAM to export results to WAMIT. For more information, confer WADAM User Manual, DNV Software.

APPENDIX A

Modifications of SIMO "sys-files" SIMO version 3.4 to 3.6

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1 Introduction

This document describes the modifications of the SIMO "system description file", the so-called "sys-file". Some data groups have been modified and some are new. The document describes the "sys-file" changes from the latest versions of SIMO 3.4 to version 3.6.

1.1 The following data groups have been modified in SIMO version 3.6.

FENDER positioning and FENDER coupling
In version 3.4, the fender plane had "infinite" dimensions
In version 3.6, the dimensions of the fender plane **may** be given

DOCKING CONE positioning and coupling
Version 3.4
Docking cone **positioning** was specified as: FIXED FORCE ELONGATION with IMETH = 4
Docking cone **coupling** was specified as: FIXED ELONGATION COUPLING with IMETH = 4
Damping data given for positioning and coupling are dummy.
Version 3.6
Docking cone **positioning** is specified as: DOCKING CONE POSITIONING
Docking cone **coupling** is specified as: DOCKING CONE COUPLING
Damping data given for positioning and coupling are used
Friction parallel to cone surface is included (input line with RADMAX and FRIC)

TIME DEPENDENT MASS
Version 3.4
Variation of mass was specified as mass at pre-defined time instances
Version 3.6
TIME DEPENDENT MASS may be of type POINT or TANK (with dimensions)
Mass/volume flow rate is specified instead of mass at pre-defined time instances
Type TANK => Tank with specified dimensions is given. (Quasi-static forces due to free-surface effects are included.)

SIMPLE WIRE COUPLING
Version 3.4
The parameter NRUN and lines with data "TSTART TSTOP RUNVEL" are removed
Version 3.6
Data regarding running of winch are moved to data group BODY COMPONENTS

MULTIPLE WIRE COUPLING
Same modifications as for SIMPLE WIRE COUPLING

DYNAMIC POSITIONING DATA
Version 3.6
Input line with parameter IDP shall now shall now precede line with IFO1 IFO2 ….
Line with IFO1 IFO2 IFO6 has additional parameters IDPMOD and ITALLOC
The KALMAN filter has been improved
The option of using a reference point at a different body has been corrected

1.2 The following data groups are new in SIMO version 3.6.

BODY COMPONENTS

LIFT LINE COUPLING
Possible to model a lifting line with line dynamics and wave and current forces

2 BODY COMPONENTS

The most extensive change in SIMO 3.6 is introduction of data group BODY COMPONENTS.
By introducing this data group, the user can for example model an object sliding along a wire. With respect to marine operations, this means that **guide-wires** can be modelled. Another feature is modelling of **sheaves**. The attachment of a line may also be modified during a simulation.

Data group "BODY COMPONENTS" can optionally be specified together within the data defining each **body**, and includes all information about equipment at the attachment points of the coupling elements that can be changed during an analysis. The presently implemented feature is winch running. Future extensions are special lifting equipment, such as heave compensators or winch equipment with automatic modes.

In SIMO versions 3.4 and earlier, winch operation was specified as a part of the data for wire couplings, and no further information about the winch could be given. SIMO version 3.6 allows the user a more detailed specification of the attachment point with relevant equipment.

In SIMO 3.4, the coupling line "SIMPLE WIRE COUPLING" included a parameter NRUN with which it was possible to adjust the length of the line during a simulation. In SIMO 3.6, the parameter NRUN shall not be given. Instead, a **winch** with specified properties is defined under data group "BODY COMPONENTS". Examples are given below.

2.1 Changes in input data.

Parameters NRUN and "TSTART TSTOP RUNVEL" (specifying winch operation) shall no longer be given as a part of the SIMPLE or MULTIPLE WIRE COUPLING data. Instead, these data are moved to data group BODY COMPONENTS.

Examples from the SIMPLE WIRE COUPLING data:

Ver. 3.4:
```
' EA      RLEN    FLEXC    NRUN    DAMPSW
 8.8E4    250.     0.       2       1000.
'  NRUN lines with data regarding winch running
' TSTART     TSTOP     RUNVEL
   5.        100.      0.2
  100.       110.      0.05
 ..............
```

Ver. 3.6:
```
BODY COMPONENTS
 ..............
' Coupling point type = FIXED
 ..............

 ..............
```

Ver. 3.6:
```
' EA      RLEN    FLEXC    DAMPSW
  8.8E4   250.      0.     1000.
  ..............

' TSTART    TSTOP    RUNVEL
```

The parameters regarding running of winch must be given as a COUPLING POINT in the data group BODY COMPONENTS. Each body defined in the system description file ("sys-file") can have several coupling points.

If the ends of a coupling line is attached (fixed) to a body and no winch operation is specified, the attachment points can be specified as in Version 3.4. Example:

```
 SIMPLE WIRE COUPLING
'CHBDY1    XBDY1    YBDY1    ZBDY1
 VESSEL_A  50.       10.      30.
'CHBDY2    XBDY2    YBDY2    ZBDY2
  HOOK       0.       0.      1.5
```

In case of attachment to a guide point or if a winch shall be run, the name of the coupling point must be specified:

```
 SIMPLE WIRE COUPLING
'Pointname
 Crane_A
'CHBDY2    XBDY2    YBDY2    ZBDY2
  HOOK       0.       0.      1.5
```

For a more detailed description, see the Users Manual, ver. 3.6.

3 Example of "sys-files" – version 3.4 and 3.6

The example consists of two "bodies", the vessel GEOF and the container LOAD. In addition we have a branch point named HOOK.

3.1 Version 3.4 – "sys-file" – running of winch

```
'*************************************************
BODY DATA SPECIFICATION
'*************************************************
' CHBDY
  GEOF
'txbdy, 3 lines
 text_1
 text_2
 text_3
'IBDTYP
   1
  ..........
  ..........
  ..........
  ..........
```

```
'*************************************************
  BODY DATA SPECIFICATION
'*************************************************
' CHBDY
LOAD
Load module
Txt_2
Txt_3
' IBDTYP
   1
  ..........
  ..........
  ..........
  ..........
'*************************************************************
 COUPLING DATA
'***************************************** CRANE WIRE ****
' CHCPL
 LIFTW
 Crane wire from crane top to hook.
 50 mm wire
'=================================================
 MULTIPLE WIRE COUPLING
'=================================================
' CHBRAN CHBDY   XBDY  YBDY  ZBDY IHLA
  HOOK   GEOF   -29.5   0.   22.4   0
'  EA     rlen  flexc  nrun dampmw irest  ehla
 137500.   10.    0.     2   1500.   0    0
'  tstart  tstop  runvel
     2.     8.      .2
    12.    18.     -.2
' IFMOCO  FTIME  BTENS
  0
'*************************************************************
 COUPLING DATA
'********************************************* SLING 1 ***
' CHCPL
SLING1
 Sling 1 from hook to load
 50 mm wire
'=================================================
 MULTIPLE WIRE COUPLING
'=================================================
' CHBRAN  CHBDY   XBDY  YBDY  ZBDY
  HOOK   LOAD    1.75   1.75   0.
'  EA     rlen  flexc  dampmw irest  ehla
 137500.   6.    0.     500.   0     0
' IFMOCO  FTIME  BTENS
  0
'*************************************************************
 COUPLING DATA
'********************************************* SLING 2 ***
' CHCPL
SLING2
  ..........
  ..........
  ..........
  ..........
```

3.2 Version 3.6 – “sys-file” – running of winch

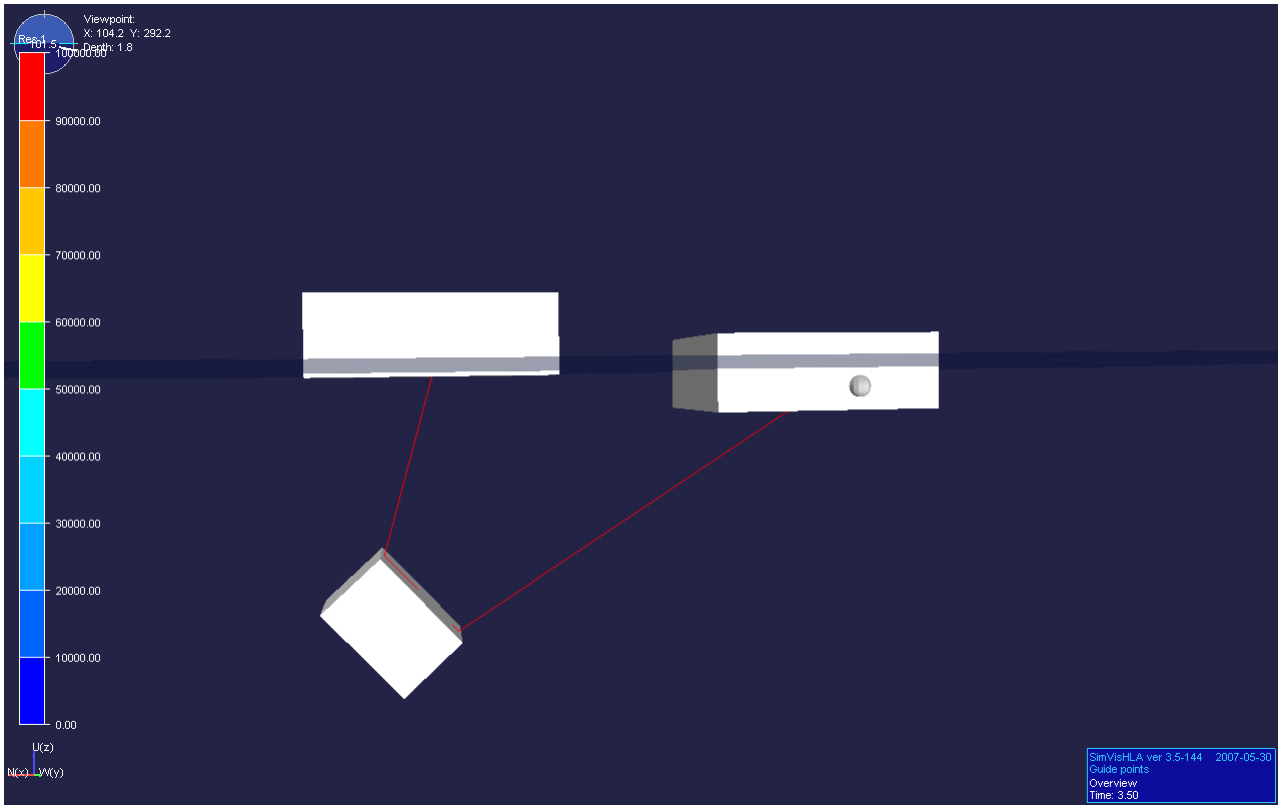
```
'*************************************************
BODY DATA SPECIFICATION
'*************************************************
' CHBDY
```

```
  GEOF
'txbdy, 3 lines
 text_1
 text_2
 text_3
'IBDTYP
   1
'================================================
 BODY COMPONENTS
'================================================
 COUPLING POINT
 Crane point
 with winch
' chcopo      cpltyp   xcpl   ycpl  zcpl
  CraneWinch  FIXED   -29.5   0.   22.4
'
 COUPLING WINCH
'  chcowi    cwico
  winch_GEOF  NRUN
'  waccm   wvelm  druma  druml   nrun
   1.      1.     100.   100.     2
'  tstart  tstop  runvel
     2.     8.      .2
    12.    18.     -.2
  ..........
  ..........
  ..........
  ..........
'************************************************
  BODY DATA SPECIFICATION
'************************************************
' CHBDY
LOAD
Load module
Txt_2
Txt_3
' IBDTYP
   1
  ..........
  ..........
  ..........
  ..........
'************************************************************
 COUPLING DATA
'****************************************** CRANE WIRE ****
' CHCPL
 LIFTW
 Crane wire from crane top to hook.
 50 mm wire
'================================================
 MULTIPLE WIRE COUPLING
'================================================
' CHBRAN CHCOPO
  HOOK   CraneWinch
'  EA     rlen  flexc  dampmw irest  ehla
 137500.   11.5    0.   1000.   0      0
' IFMOCO  FTIME  BTENS
  0
'************************************************************
 COUPLING DATA
'********************************************** SLING 1 ***
' CHCPL
SLING1
 Sling 1 from hook to load
 50 mm wire
'================================================
 MULTIPLE WIRE COUPLING
```

```
'=================================================
' CHBRAN  CHBDY   XBDY  YBDY  ZBDY
  HOOK   LOAD    1.75   1.75   0.
'  EA     rlen  flexc  dampmw irest  ehla
 137500.   6.    0.     500.   0     0
' IFMOCO  FTIME  BTENS
  0
'*****************************************************
 COUPLING DATA
'****************************************** SLING 2 ***
' CHCPL
SLING2
  ..........
  ..........
  ..........
  ..........
```

3.3 Modelling a body sliding along a flexible wire – guide points

The example consists of 3 bodies. VESSEL_A, VESSEL_B and LOAD. LOAD is sliding along a wire that goes from VESSEL_A to VESSEL_B. VESSEL_A and VESSEL_B are of type 4 and cannot move. LOAD has two guide points.




```
'************************************************************
SYSTEM DESCRIPTION SIMO
'************************************************************
' txsys, 3 lines
Test of guide points
Txt_1
Txt_2
'LENUNI TIMUNI MASUNI GRAV  RHOW  RHOA
 m      s      Mg     9.81  1.025 0.00125
'DEPTH  DIRSLO   SLOPE
 1000.
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
'CHBDY
 VESSEL_A
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   4
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob     Zglob       Phi      Theta       Psi
   0.0         0.0       -10.        0.0       0.0        0.0
```

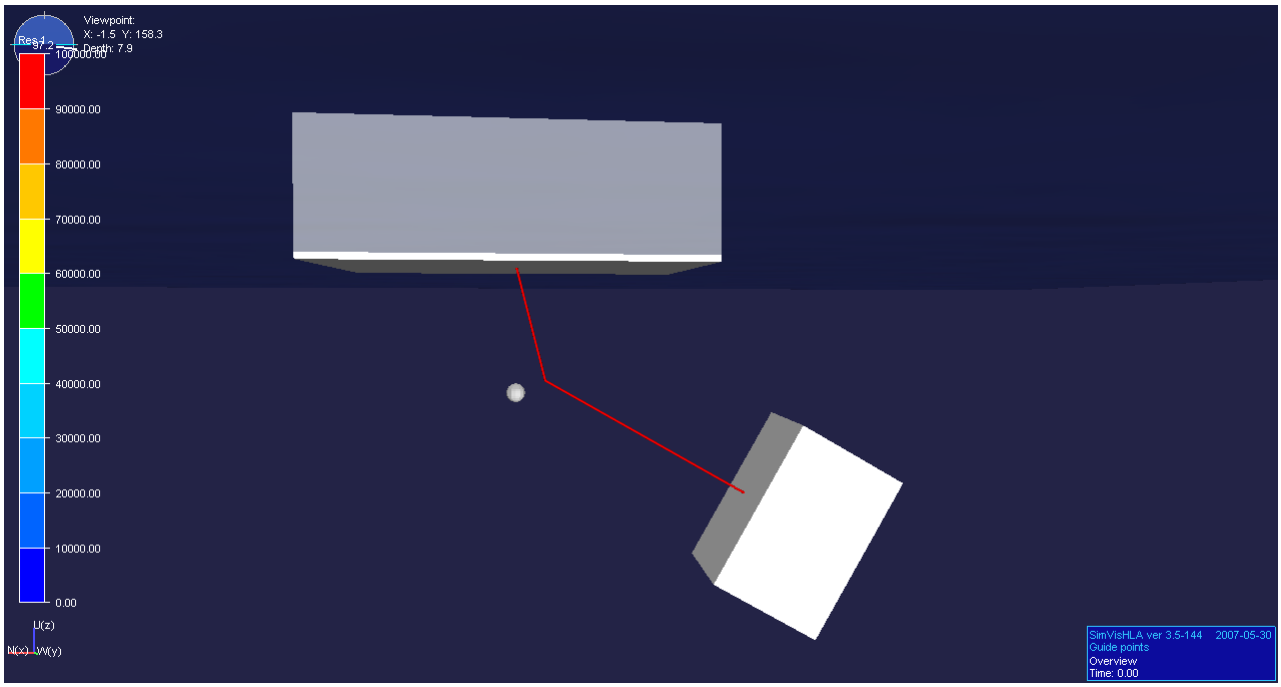
```
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
'CHBDY
 VESSEL_B
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   4
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob    Zglob       Phi     Theta      Psi
   100.        0.0       0.         0.0      0.0       0.0
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
'CHBDY
 LOAD
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   1
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob    Zglob       Phi     Theta      Psi
   114.        0.0       -10.        0.0      0.0       0.0
'============================================================
BODY MASS DATA
'============================================================
'txmass, 2 lines
24-4-02 9:03

'xcog        ycog       zcog
 0.          0.0        0.
'------------------------------------------------------------
 MASS COEFFICIENTS
'------------------------------------------------------------
'   rm     rixx     riyx    riyy      rizx    rizy    rizz
  1000.    10000.   0.000   40000.    0.000   0.000   40000.
'------------------------------------------------------------
 GRAVITY FORCE INCLUDED
'------------------------------------------------------------
LINEAR DAMPING
'
txt1
txt2
'  dl1     dl2     dl3     dl4     dl5     dl6
   50.      0.      0.      0.      0.      0.
    0.     50.      0.      0.      0.      0.
    0.      0.     50.      0.      0.      0.
    0.      0.      0.    200.      0.      0.
    0.      0.      0.      0.    200.      0.
    0.      0.      0.      0.      0.    200.
' ==================== BODY COMPONENTS
BODY COMPONENTS
' ==============
COUPLING POINT
' --------------
First guide point
at body LOAD
'  chcopo         cpltyp   xcpl    ycpl    zcpl
```

```
   Guide1_at_LOAD  guide    -14.    0.      10.
' dia    dv1    dv2    dv3
  .2      2.     0.     0.
' ==============
COUPLING POINT
' --------------
Second guide point
at body LOAD
'  chcopo          cpltyp   xcpl    ycpl    zcpl
   Guide2_at_LOAD  guide    14.     0.      10.
' dia    dv1    dv2    dv3
  .2      2.     0.     0.
' ####################
   COUPLING DATA
' ####################
CPL1
' ==================
Coupling between
VESSEL_A and VESSEL_B
' ==================
SIMPLE WIRE COUPLING
' ==================
'  chbdy1    xbdy1    ybdy1    zbdy1
  VESSEL_A     0.       0.       0.
' ------------------------------------ Load
'  chbdy2    xbdy2    ybdy2    zbdy2
  VESSEL_B     0.       0.       0.
' ------------------------------------
'  nguide
    2
'  chgupo          iactiv
 Guide1_at_LOAD       1
 Guide2_at_LOAD       1
'    EA    RLEN      FLEXC       DAMPSW
  8.8E4   147.8      0.          1000.
'  ifmoco   ftime   btens
     0        0.    100.
'*******
  END
'*******
```

3.4 Modelling a double pendulum – guide points

The example consists of 3 bodies. VESSEL_A, VESSEL_B and LOAD. VESSEL_B is not shown in the figure. LOAD is hanging in a wire that goes through "guide hole" with diameter 10 m in body. VESSEL_B. VESSEL_A and VESSEL_B are of type 4 and cannot move.




```
'************************************************************
SYSTEM DESCRIPTION SIMO
'************************************************************
' txsys, 3 lines
Test of guide points
Txt_1
Txt_2
'LENUNI TIMUNI MASUNI GRAV  RHOW  RHOA
 m      s      Mg     9.81  1.025 0.00125
'DEPTH  DIRSLO   SLOPE
 1000.
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
'CHBDY
 VESSEL_A
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   4
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob     Zglob       Phi      Theta       Psi
   0.0         0.0        0.         0.0       0.0        0.0
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
```

```
'CHBDY
 VESSEL_B
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   4
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob    Zglob       Phi     Theta       Psi
     0.         0.0      -20.       0.0      0.0        0.0
' ==================== BODY COMPONENTS
BODY COMPONENTS
' ==============
COUPLING POINT
' --------------
First guide point
at body LOAD
'  chcopo            cpltyp   xcpl    ycpl    zcpl
 Guide_at_VESSEL_B   guide     0.      0.      0.
' dia    dv1   dv2   dv3
  10.    0.    0.    1.
' ==============
'************************************************************
BODY DATA SPECIFICATION
'************************************************************
'CHBDY
 LOAD
'txbdy, 3 lines
txbdy
txbdy
txbdy
'IBDTYP
   1
'============================================================
BODY LOCATION DATA
'============================================================
'  Xglob       Yglob    Zglob       Phi     Theta       Psi
  -48.301      0.0      -45.        0.0      60.        0.0
'============================================================
BODY MASS DATA
'============================================================
'txmass, 2 lines
24-4-02 9:03

'xcog        ycog       zcog
 0.          0.0        0.
'-----------------------------------------------------------
 MASS COEFFICIENTS
'-----------------------------------------------------------
'    rm     rixx     riyx    riyy      rizx    rizy    rizz
  1000.    10000.   0.000   40000.    0.000   0.000   40000.
'-----------------------------------------------------------
 GRAVITY FORCE INCLUDED
'-----------------------------------------------------------
' ####################
   COUPLING DATA
' ####################
CPL1
' ==================
Coupling between
VESSEL_A and LOAD
' ==================
SIMPLE WIRE COUPLING
' ==================
```

```
'  chbdy1    xbdy1    ybdy1    zbdy1
  VESSEL_A     0.       0.       0.
' ------------------------------------ Load
'  chbdy2    xbdy2    ybdy2    zbdy2
  LOAD         0.       0.      10.
' ------------------------------------
'  nguide
    1
'  chgupo                iactive
 Guide_at_VESSEL_B           1
'   EA    RLEN      FLEXC       DAMPSW
  8.8E6    60.5      0.          1000.
'  ifmoco   ftime   btens
     0        0.    100.
'*******
  END
'*******
```